University of M'Sila
Maths & CS Faculty
Computer Science Department

Exam (S1)
Machine Structure 1

Date : 01/14/2024
Duration : 01h :30

ممنوع استخدام الآلة الحاسبة والهاتف النقال (A)

First and Last Name: …… **Correction** …… **Group:**……

Exercise 1: (4.5 Pts = 3.5(2.25 (0.75 ×3) + 0.75 + 0.5)+1)

1) Make the following conversions**:**

10	2	8	16
$16^2 + 8^2 + 2^4 + 2^2 + 16^{-1} + 8^{-1}$	101010100.0011	524.14	154.3
62.625	111110.101	76,5	3E.A
174.375	10101110.0110	256.3	AE,6

$39_{(16)}$= 0101 0111 $_{(BCD)}$ = 1000 1010 $_{(Excess3)}$ = 57 $_{(10)}$

$1101011_{(Gray)}$ = 77 $_{(10)}$ = 1001101 $_{(2)}$

2) Perform the following operation in **Excess-3**: $65_{(8)} + 54_{(16)}$

$65_{(8)} = 53_{(10)}$ = 1000 0110 (EX3)

$54_{(16)} = 84_{(10)}$ = 1011 0111 (EX3)

```
 53   0 1 0 1 1 1 1   1000   1 0 1 1 1 0
+84   0 0   1 1     1011     0 1 1 1
      0 1   1 1     0011     1 1 0 1
    - 0 0   1 1  + 0011   - 0011
      0 1 0 0     0 1 1 0    1 0 1 0
        1           3          7
```

Exercise 2: (4.5 Pts = 2.25 (0.75 ×3) + 2.25 (1.5+0.75))

1)Give **the decimal values** corresponding to the octal content on **8 bits**, knowing that this content is represented in **S-Mag,1'sC, 2'sC**: $354_{(8)}$

S-Mag : 11101100 $_{(S\text{-}Mag)}$ = -(1101100)$_{(2)}$ = -108$_{(10)}$

1'sC : 11101100 $_{(1'sC)}$ = -(00010011) $_{(2)}$ = -19$_{(10)}$

2'sC : 11101100 $_{(2'sC)}$ = -(00010100) $_{(2)}$ = -20$_{(10)}$

2) Perform the following operations on **9 bits** in **1'sC**and give the results in decimal:

$-56_{(16)} + 74_{(8)}$

$-56_{(16)} = -(01010110)_{(2)} = 110101001_{(1C)}$ (9bits)

$+74_{(8)} = 000111100_{(1C)}$

```
  110101001
+ 000111100
  111100101(1C) = - (000011010)(2)= - 26(10)
```

$+56_{(8)} + FD_{(16)}$

```
  000101110
+ 011111110
  100101100(1C)
```

Incorrect Result (Overflow)

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Exercise 1: (4.5 Pts = 3.5(2.25 (0.75 ×3) + 0.75 + 0.5) +1)

1) Make the following conversions:

10	2	8	16
$16^2+8^2+2^4+2^2+16^{-1}+8^{-1}$	1010 10100,0011	524,14	154,3
62,625	111 110,101	76,5	3E,A
174,375	1010 1110,0110	256,3	AE,6

$39_{(16)}$ = ..0101 0111.. (BCD) = ..1000 1010.. (Excess3) = ..57.. (10)

$1101011_{(Gray)}$ = ..77.. (10) = ..100 1101.. (2)
1001101

2) Perform the following operation in **Excess-3** : $65_{(8)} + 54_{(16)}$

65 (8) = 53 (10) = 1000 0110 (XS3)

54 (16) = 84 (10) = 1011 0111 (XS3)

53 → 0011 1000 0110
+84 → + 0011 1011 0111
0111 0011 1101
− 0011 + 0011 − 0011
0100 0110 1010
1 3 7

Exercise 2: (4.5 Pts = 2.25 (0.75 ×3) + 2.25 (1.5+0.75))

1) Give **the decimal values** corresponding to the octal content on **8 bits**, knowing that this content is represented in **S-Mag, 1'sC, 2'sC:** $354_{(8)}$ ~~11 101 100~~ (8 bits)

S-Mag : 11 101 100 (SMag) = − (1101100)(2) = − 108 (10)

1'sC : 11 101 100 (1C) = − (000 100 11)(2) = − 19 (10)

2'sC : 11101100 (2C) = − (000 10100)(2) = − 20 (10)

2) Perform the following operations on **9 bits** in **1'sC** and give the results in decimal:

-56 (16) + 74 (8)

−56 (16) = −(0101 0110)(2) = 1101 0100 1 (1C)
+74 (8) = 0 0011 1100 (1C) (9 bits)
1101 0100 1
+ 0 0011 1100
1 1 0 0 0 0 1 0 1 (1C) = −(0000 1101 0)(2)
= −26 (10)

+56 (8) + FD (16)

0 0010 1110
+ 1 1111 1110
1 0 0010 1100 (1C)
−
Incorrect Result
(overflow) :

Exercise 3:

1) $-43,625 \times 2^{-107} = -101011,101 \times 2^{-107}$

$= -1,0101111101 \times 2^{-102}$

Normalized

$S = 1$

$M = 0101111101$

$BE = -102 + 127 = 25_{(10)} = 11001_{(2)}$

1	000 11001	010 11110 1	0 ---- 0
S	BE	M	15(0)

$+53,75 \times 2^{-134} = +110101,11 \times 2^{-134}$

$= +1,10101111 \times 2^{-129}$

$= +0,0011010111 \times 2^{-126}$ Denormalized

$S = 0$; $M = 00110101111$; $BE = 0$

0	0000 0000	00110101111	0 --- 0
			13(0)

2) $X = 24E\ 0000_{(16)}$

0	010 0100	110	0 ---- 0
S	BE	M	20(0)

$0 < BE < 255$

Normalized

$BE = 0100\ 1001_{(2)} = 73_{(10)}$

$RE = BE - 127 = 73 - 127 = -54_{(10)}$

$S = 0 \Rightarrow X > 0$

$M = 11$

$X = +1,11_{(2)} \times 2^{-54}$

$= +1,75_{(10)} \times 2^{-54}$.

$Y = 80500000_{(16)}$

1	000 0000	0	101	0 ---- 0
S	BE		M	20(0)

$BE = 0$

Denormalized

$BE = 0$

$S = 1 \Rightarrow Y < 0$

$M = 101$

$Y = -0,101_{(2)} \times 2^{-126}$

$= -0,625_{(10)} \times 2^{-126}$

Exercise 4:

1) $F1(X,Y,Z) = (X+Y)Z + \bar{X}(\bar{Y}+Z) + \bar{Y}$

$= XZ + YZ + \bar{X}\bar{Y} + \bar{X}Z + \bar{Y}$

$= Z(X + \bar{Y} + \bar{X}) + \bar{Y}(\bar{X} + 1)$

$= Z + \bar{Y}$.

X	Y	Z	F1
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	1

2)

1st C.F (D.C.F).

$F1 = \Sigma(000, 001, 011, 100, 101, 111)$

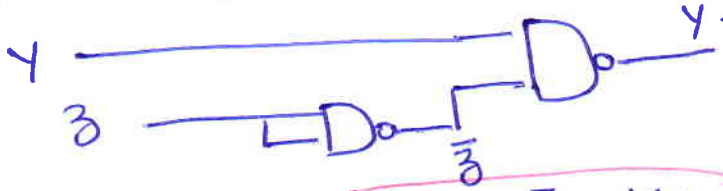
$= \bar{X}\bar{Y}\bar{Z} + \bar{X}\bar{Y}Z + \bar{X}YZ + X\bar{Y}\bar{Z} + X\bar{Y}Z + XYZ$

2nd C.F (C.C.F):

$F1 = \Pi(010, 110)$

$= (X + \bar{Y} + Z)(\bar{X} + \bar{Y} + Z)$

3) Logigram of F1 (simplified) only with NANDS:



4) $F2(A,B,C) = (A+\bar{B}+\bar{C})(A+\bar{B}+C)(A+B+\bar{C})$

$= (A+\bar{B}+\bar{C}C)(A+\bar{B}B+\bar{C})$

$= (A+\bar{B})(A+\bar{C})$

$= A + \bar{B}\bar{C}$.

5) $F_2 = (A+\bar{B}+\bar{C})(A+\bar{B}+C)(A+B+\bar{C})$

$0 \quad 1 \quad 0 \quad 0 \quad 1 \quad 0 \quad 0 \quad 0 \quad 1$

$= \Pi(3,2,1)$

C \ AB	00	01	11	10
0	1 (0)	0 (2)	1 (6)	1 (4)
1	0 (1)	0 (3)	1 (7)	1 (5)

$F_2 = A + \bar{B}\bar{C}$ (SOP)

$= (A+\bar{B})(A+\bar{C})$ (POS).

$F3 = \Sigma(0,1,3,5,6,10,15) + \phi(2,4,7,11)$

CD \ AB	00	01	11	10
00	1 (0)	X (4)	0 (12)	0 (8)
01	1 (1)	1 (5)	0 (13)	0 (9)
11	1 (3)	X (7)	1 (15)	X (11)
10	X (2)	1 (6)	0 (14)	1 (10)

$F3 = \bar{A} + CD + \bar{B}C$. (SOP)

$= (\bar{A}+C)(\bar{A}+\bar{B}+D)$ (POS)